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Musculature of facial scent glands in the muntjac

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INTRODUCTION

Many species in the families *Bovidae* and *Cervidae* have facial scent glands (Haltenorth, 1963). Of all species of artiodactyls, the muntjacs of South East Asia (*Muntiacus* sp.) are the best provided with such glands and they are the only deer to have frontal glands (Flower & Lydekker, 1891), with a pair of slits on the face in line with the antler pedicles (Dubost, 1971). In addition, muntjacs possess a pair of huge preorbital glands (Fig. 1).

Males have larger preorbital glands than females, and those of *M. reevesi* are larger than those of *M. muntjak*. Muntjacs use their facial glands to mark the ground, and more rarely, to mark conspecifics (Barrette, 1975). They open their preorbital glands during defaecation and urination, and also very occasionally as part of some social display (Dubost, 1971). When the glands are opened during defaecation or urination, their secretion is licked with an upward slapping movement of the tongue.

Muntjacs can open their preorbital glands alone, or their frontal glands alone, or both pairs of glands together. Glands on both sides are always opened synchronously. The lips of the frontal glands can be pulled apart no more than 1 cm. Accordingly no conspicuous muscles seem to be associated with them, at least in newborn muntjacs. The frontal glands are sometimes opened when a muntjac chews on a hard object (e.g. a piece of bone) or bites a conspecific. For that reason it seems that they can be opened involuntarily as a result of a strong contraction of other facial muscles. There is therefore little need for any specialized musculature to activate the frontal glands.

On the other hand, not only can the preorbital glands be opened much wider than the frontal glands, but they can be everted as well. Once the lateral and medial borders of the gland are pulled apart, the underlying glandular tissue can be pushed out (Figs. 2 and 3). Even fawns only a week old can fully evert their preorbital glands.

MATERIAL

In order to discover how the gland could be everted to such an extent I have examined the facial musculature associated with the facial glands in two male muntjacs (*M. reevesi*) that died when about 10 days of age. I have also examined the facial muscles of some North American deer (*Odocoileus hemionus*, 3 adult females; *Odocoileus virginianus*, 2 adult males; *Cervus canadensis*, 1 yearling male; and *Alces alces*, 1 adult male). These North American *Cervidae* have much smaller preorbital

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Fig. 1. Closed preorbital gland of an adult male *Muntiacus reevesi.*

glands. It was decided to compare their facial muscles with those of muntjacs. The muscle nomenclature employed is identical with that used by Meinertz (1954) for the musk-ox (*Ovibos moschatus*).

OBSERVATIONS AND DISCUSSION

In the four species of North American cervids examined, apart from M. orbicularis oculi, all the facial muscles located around the preorbital glands (M. naso-labialis superficialis, M. frontalis, M. maxillo-labialis and M. retractor anguli oculi medialis profundus) were thin sheets of tissue. (This is also true for *Elaphurus davidianus*; Wood Jones, 1951). The muscles have no discrete insertion; their contraction would seem barely able to pull apart the edges of the preorbital glands. Since none of those muscles is directly inserted on the preorbital gland they probably open the gland indirectly by acting on the surrounding skin. The lack of conspicuous musculature is well in line with the small size of the preorbital glands and their relatively infrequent use by North American cervids.

Although the muntjacs examined were only 10 days old, their facial muscles were already thicker and better developed than those of the adult North American cervids studied. In muntjacs, the frontalis muscle, instead of being a thin continuous

Fig. 2. Adult male *Muntiacus reevesi* with fully everted preorbital glands. His frontal glands are closed.

sheet, is present as two discrete bundles. One bundle is attached to the upper medial edge of the preorbital gland and its fibres run upward towards the antler pedicles (Fig. 4A). The second bundle runs across the face, and sends fibres to the frontal glands as well (Fig. 4B). I could find no other muscles associated with the frontal

Fig. 3. Five month old male *Muntiacus reevesi* with fully everted preorbital glands.

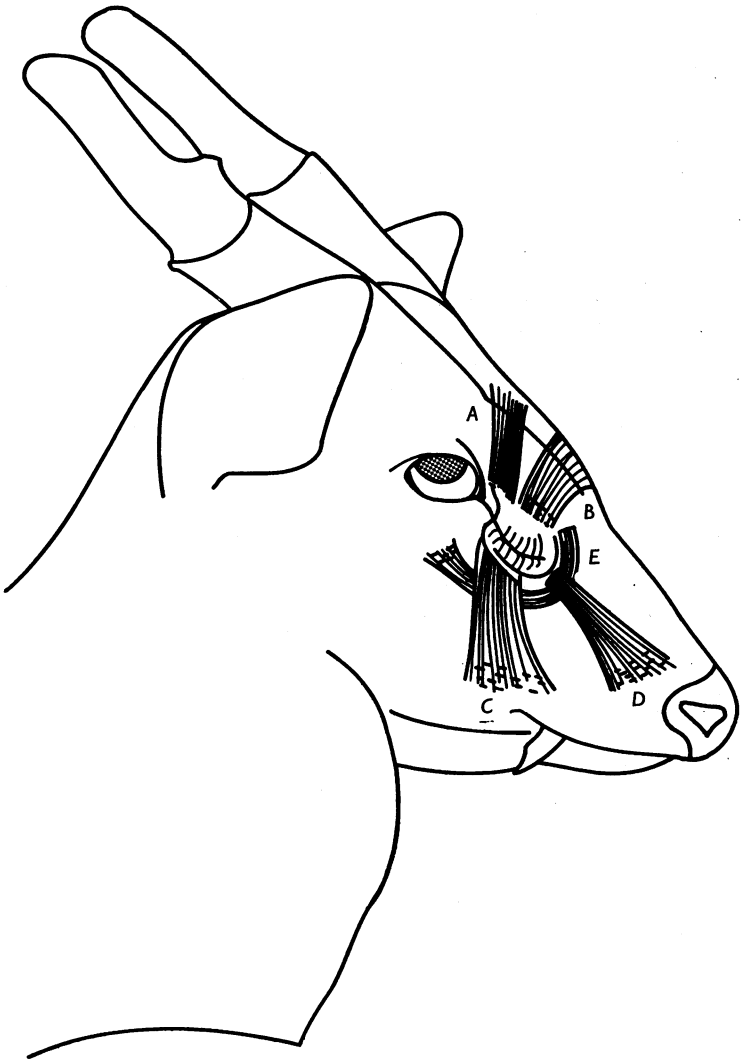

Fig. 4. Tracing from a photograph showing an adult male's closed preorbital gland, over which the muscles associated with the gland (as found in newborn *Muntiacus reevesi*) have been drawn.

glands in the specimens examined. The muscle corresponding to the M. maxillo-labialis of North American cervids is also split into two separate bands in the muntjac. A ventral band is attached to the lateral border of the preorbital glands and its fibres run forward (Fig. 4C). A dorsal band has its fibres converging to a discrete insertion point near the distal end of the gland (Fig. 4D). Figure 3 shows the nose of a five month old male, wrinkled as the maxillo-labialis muscle pulls the distal end of the gland forward.

It would seem that, no matter how strongly the muscles so far described were to contract. they could not evert the gland as much as it often is (Figs. 2 and 3). One

muscle (not found in North American cervids) seems to be responsible for the extreme eversion of the preorbital glands. It is a relatively thick semicircular ring surrounding the distal part of the gland and located deep under the insertion of the maxillo-labialis. Its origin is on the superior edge of the lacrimal pit. It runs closely along the gland and has a diffuse insertion on the lateral side of the gland, under the inferior band of the maxillo-labialis muscle (Fig. 4E). The simultaneous contraction of the eversion muscle and of the two bands of the maxillo-labialis muscle squeezes out the distal portion of the preorbital glands as can be seen in Figure 3.

Dissections of adult muntjacs of both sexes, and electromyographic observations of the facial muscles associated with the preorbital glands, would almost certainly reveal more about the operation of the glands. The present report shows that the specialized musculature of the preorbital glands of muntjacs is already well developed at birth. This is perhaps not surprising, given the important role played by scent marking in the social behaviour of muntjacs (Barrette, 1975).

SUMMARY

The muscles associated with the very large preorbital glands of muntjacs (*Muntiacus*) are described. Although the two muntjac fawns examined were only 10 days old, their muscles were proportionately larger than those in adult specimens of North American cervids. A muscle, not found in North American cervids, but well developed in muntjacs, is probably responsible for the eversion of muntjacs' preorbital glands.

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